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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. |
|-----------------|-------------|----------------------|---------------------|
| 08/937,721 | 09/25/97 | GESSERT | NREL-96-48 |

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EXAMINER
MULPURI, S

ART UNIT
2812

PAPER NUMBER
17

DATE MAILED: 05/18/00

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.
08/937,721

Applicant(s)
Gessert

Examiner
S. Mulpuri

Group Art Unit
2812



☒ Responsive to communication(s) filed on Oct 29, 1900

☐ This action is **FINAL**.

☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire 3 month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

☒ Claim(s) 1, 2, and 4-6 is/are pending in the application.

Of the above, claim(s) _____ is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) 1, 2, and 4-6 is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been
☐ received.

☐ received in Application No. (Series Code/Serial Number) _____.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☐ Notice of References Cited, PTO-892

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). _____

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---

Art Unit:

DETAILED ACTION

1. The request filed on 10/29/99 for a Continued Prosecution Application (CPA) under 37 CFR 1.53(d) based on parent Application No. 12 is acceptable and a CPA has been established. An action on the CPA follows.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-2,4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Admitted Prior Art in combination with Schroen et al.

Admitted Prior Art discloses a method of making CDS/CdTe device. But does not disclose exposing the p-type CdTe to the Ar ions or atoms to reduce contact resistance. Schroen et al discloses evacuating residual gas to pressure of 5×10^{-7} Torr, providing Ar gas and creating Ar ion beam using glow discharge at 1000 volts and then exposing Ar ions to the doped semiconductor substrate and then forming ohmic contact. It would have been obvious to one of ordinary skill in the art to expose Ar ions to surface of CdTe to obtain low ohmic contact resistance. The mean free path in the invention of Schroen et al would have been same as claimed mean free path because the experimental conditions in Schroen et al are substantially same as instantly claimed conditions.

Art Unit:

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Admitted Prior Art in combination with Schroen et al as applied to claims 1-4 above, and further in view of Lee et al..

Neither admitted Prior Art nor Schroen et al disclose an aperture dimension. Lee et al disclose an aperture diameter of Ar plasma is 3 cm(see col.3, lines 35-63). It would have been obvious to one of ordinary skill in the art to use chamber having large aperture of 3 cm in the invention of Schroen et al.

because aperture size suitable for the ion etching ion cleaning on the surface of the substrate.

Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Admitted Prior Art in combination with Schroen et al as applied to claim s 1-4 above, and further in view of Ebe et al.

Neither Admitted Prior art nor Schroen et al disclose using angle implantation. Ebe et al disclose using exposing Ar ions at an angle of 45 degrees to substrate(see fig.4, col. 5, 60-67). It would have been obvious to one of ordinary skill in the art to use angle implantation in the invention of Schroen et al because Ebe et al teaches angle implantation is suitable for finally making integrated circuits.

Response to the applicant's arguments: Applicant amended the claims to limit p-type CdTe surface and dry etching technique. However, admitted Prior Art discloses forming solar cells from single crystalline materials, amorphous material or polycrystalline materials(see page 3, lines 1-9, page 12-20) and wet etching and dry etching (see page 6, lines 6-14).

Art Unit:

Applicant argues that admitted prior art does not disclose a dry "etch process" for providing a uniform and reproducible surface of low-resistance electrical contact between metal layer and a layer polycrystalline p-type CdTe prior to additional contact interface or semiconductor layer to reduce contact resistance. However, modified invention of admitted prior art, as modified by the teachings of Schroen et al for Ar irradiation, Lee et al for aperture of 3 nm diameter and Ebe et al for angular irradiating of Ar on the target.

Admitted art teaches of forming solar cell metallization on II-VI semiconductor compound, could be p-type CdTe layer. Schroen et al et al is simply relied on Ar irradiation on surface p-type CdTe. It is agreed with applicant Schroen et al exemplifies the process with Si. However, Schroen et al clearly mention inventive concept of irradiation includes II-VI compounds.

Applicant argues that Schroen et al uses high voltage 1-10 keV which includes recite voltages.

It is agreed that Schroen et al grows silicon oxide, minimum of 10 angstroms, prior to metal formation. However, Schroen et al obtains synergistic advantage by both Ar irradiation and silicon oxide as well for reducing the contact resistance. However, Admitted prior art, as modified by Schroen et al, would complete, subsequent to irradiation of Ar, the structure forming metal on p-type CdTe.

Applicant argues that Lee et al uses external plasma gun and no reference to condition polycrystalline p-CdTe surface prior to deposition of an additional semiconductor layer. However,

Art Unit:

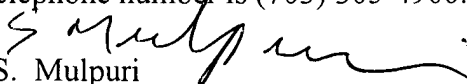
Lee et al is relied on the teaching of plasma apparatus with aperture diameter of 3 cm for bombarding Ar ions on substrate for effective Ar irradiation. It does not matter whether Lee et al uses glow discharge in the presence of inert gas, or forming oxide instead of metal or semiconductor layer, which are irrespective claimed language.

Applicant argues that teachings of Ebe et al is nonrelavent to the instant invention. However, the purpose of the Schroen et al and Abe et al is to reduce contaminants by using Ar irradiation. It does not matter whether the substrate is semiconductor or other, angle implantation of Ar is preferred, when taken the efficiency of sputtering into account Ebe et al further teach angle depends on the kind of inert ions and material of the substrate.

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Morita disclose angle implantation of Ar ions. Wotherspoon teaches etching of CdTe layer.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to S. Mulpuri whose telephone number is (703) 305-5184. The fax phone number for the organization where this application or proceeding is assigned is (703) 305-3432.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-4900.


S. Mulpuri

Patent examiner

Technology center 2800

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5/17/00